**UTAH GEOLOGICAL SURVEY**
*a division of*
**UTAH DEPARTMENT OF NATURAL RESOURCES**

**Plate 1**
**Utah Geological Survey Map 157**
**Geologic Map of the Harley Dome Quadrangle**

4162 IV SE (DRY CANYON) · 4162 I SW (BRYSON CANYON) · 4162 I SE (BARX WASH) · 4162 III NE (ANTONE CANYON) · 4162 II NE (BITTER CREEK WELL) · (DANISH FLAT) 4162 III SE · 4162 II SW (AGATE) · (WEST WATER) 4162 II SE

Base map from the U. S. Geological Survey
Harley Dome 7.5′ Quadrangle, 1970

Field work completed 1989 - 1991
Lori J. Douglas, Cartographer

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1973

SCALE 1:24 000

1 MILE · 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET · 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

1994 Magnetic North
Declination at center of sheet
12°36′ E
224 mils

UTAH
QUADRANGLE LOCATION

# GEOLOGIC MAP OF THE HARLEY DOME QUADRANGLE, GRAND COUNTY, UTAH

**by**

**Grant C. Willis**

**1994**

**UTAH GEOLOGICAL SURVEY**
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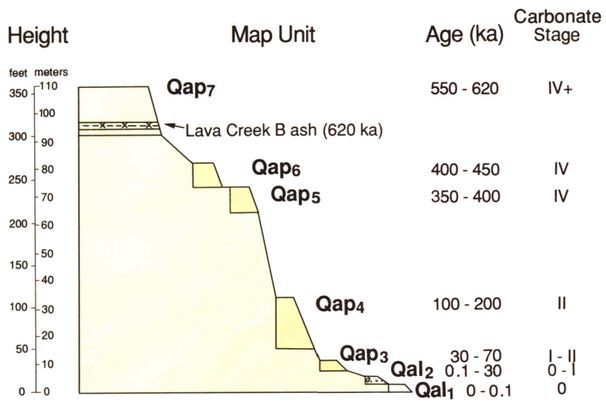
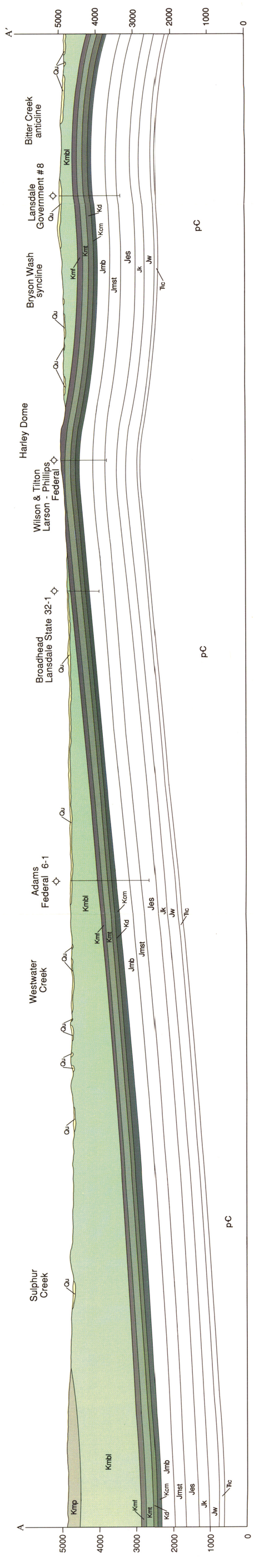
**UTAH DEPARTMENT OF NATURAL RESOURCES**

**Plate 2**
**Utah Geological Survey Map 157**
# Geologic Map of the Harley Dome Quadrangle




**Correlation of Pediment and Terrace-mantle Deposits**

Diagram of major alluvial units, relative elevation above Westwater Creek, and estimated age. Ages are estimated using calculated rates of pedogenic (soil) carbonate accumulation and local downcutting of the Colorado River and its tributaries. The 620,000-year-old Lava Creek B volcanic ash, exposed near the base of the highest and oldest pediment-mantle deposits, is the datum for calculations. See discussion in the text. Mapped deposits without number subscripts generally have a wider age range.




## DESCRIPTION OF MAP UNITS

**Qu** — Undivided Quaternary deposits - *Shown in cross section only.*

**Qfd** — Fill and disturbed areas - *Moderately to poorly sorted gravel and fill; includes deposits of waste materials from screening and washing of gravel and adjacent excavated areas. (Locally thick highway and railroad fill and small dams built across ephemeral washes were not mapped separately).*

**Qe** — Eolian deposits - *Well- to very well-sorted sand and silt, and minor loess; blankets benches of the Dakota Sandstone in areas mostly free of alluvial deposits; has a distinctive reddish-orange color imparted by source materials (Jurassic and Triassic "red rock" formations exposed to the southwest); ranges from 0 to 40 feet (0 - 12 m) thick.*

**Qae** — Mixed alluvial and eolian deposits - *Moderately to well-sorted clay to boulder-sized material; dominated by alluvial processes; eolian component varies from locally absent to moderate; intermediate between, and gradational with, $Qal_1$, $Qal_2$, and Qea; similar to Qam but has more sand, pebbles, and boulders, and less clay and silt; 0 to 30 feet (0 - 9 m) thick.*

**Qea** — Mixed eolian and alluvial deposits - *Moderately well- to very well-sorted, sand, silt, and loess, with sparse pebbles and cobbles; eolian component generally more abundant than alluvial component; has a distinctive reddish-orange color imparted by eolian source (Mesozoic "red rock" formations exposed to the southwest); present on older surfaces in areas of limited alluvial influence; ranges from 0 to 10 feet (0 - 3 m) thick; gradational with other Quaternary surficial deposits.*

**Qac** — Mixed alluvial and colluvial deposits - *Poorly to moderately sorted, clay- to boulder-size material deposited on and at the base of slopes, especially near the base of dissected pediments; many smaller deposits are not mapped separately; 0 to 20 feet (0 - 6 m) thick; gradational with other Quaternary surficial deposits.*

Alluvial deposits are common on terraces and pediments ranging from present drainage bottoms to about 360 feet (110 m) above adjacent drainages. These deposits have been lumped into a limited number of units to facilitate mapping. Numbers denote relative ages and heights above adjacent drainages; level 1 is the youngest (active drainages) and level 7 is the oldest and highest. See the discussion in the text.

**Qam** — Alluvial mud and sheet-wash deposits - *Moderately well-sorted silt, clay, and some sand; locally with minor coarse clastic or eolian deposits; covers broad surfaces with poorly developed drainages; derived primarily from the Mancos Shale; generally equivalent in age and gradational with units $Qal_1$, $Qal_2$, Qae, and Qea; ranges from 0 to 20 feet (0 - 6 m) thick.*

**$Qal_1$** — Younger alluvial deposits - *Poorly to moderately sorted boulders, cobbles, sand, silt, and clay along major stream channels; present up to 10 feet (3 m) above active drainages; includes deposits of $Qal_2$ where undifferentiated or too small to map separately; gradational with other Quaternary surficial deposits; ranges from 0 to about 20 feet (0 - 6 m) thick.*

**$Qal_2$** — Older alluvial deposits- *Poorly to moderately sorted boulders, cobbles, sand, silt, and clay that have been incised by downcutting of washes; similar to $Qal_1$ but upper surface of deposit is 10 to 30 feet (3 - 9 m) above adjacent drainages; locally, materials are being deposited on these surfaces from small side washes and adjacent slopes; gradational with other Quaternary surficial deposits; differentiated only near larger drainages; in other areas equivalent deposits are lumped with, and mapped as, Qae and Qam; ranges from 0 to about 10 feet (0 - 3 m) thick.*

**$Qap_{3-7}$** — Pediment-mantle and terrace deposits - *Poorly to moderately sorted boulders, cobbles, sand, silt, and clay; forms a thin veneer on pediment and terrace surfaces; range from 0 to about 80 feet (0 - 24 m) thick; $Qap_3$ ranges from 20 to 40 feet (6 - 12 m) above Westwater Creek, the local base level; $Qap_4$ from 50 to 110 feet (15 - 34 m); $Qap_5$ from 210 to 240 feet (64 - 73 m); $Qap_6$ from 240 to 270 feet (73 - 82 m); and $Qap_7$ from 300 to 360 feet (91 - 110 m). Pediments in the northeastern area are in the Bryson Wash drainage, but labeling is continued from Westwater Creek to avoid numbering conflicts along the drainage divide.*

**Qvb** — Lava Creek B volcanic ash - *Pale-gray to white, laminated to cross-stratified volcanic ash mixed with varying amounts of alluvial materials; is present within the highest and oldest pediment deposits ($Qap_7$) 5 to 10 feet (1.5 - 3 m) above the base, and is shown by a "---x---x---" line on the map; exposed along pediment base for a distance of about 1 mile (1.6 km); up to about 14 feet (4 m) thick; is 620,000 years old (Izett, 1981; Izett and Wilcox, 1982).*

Mancos Shale

**Kmp** — Prairie Canyon Member - *Medium- to dark-gray, interlayered mudstone and siltstone, and pale- to medium-grayish-brown, fine- to very fine-grained sandstone; sandstone forms coarsening-upward sequences of several beds that are generally 1 to 5 inches (2.5 - 12.5 cm) thick; bivalves and trace fossils are locally common; has ripple laminations, sole marks, and horizontal to lenticular bedding; forms a low cuesta; thickness was 1,400 to 1,800 feet (430 - 550 m), however only about 300 feet (90 m) is preserved in the quadrangle.*

**Kmbl** — Lower part of the Blue Gate Member - *Medium- to dark-gray, brownish-gray, or black mudstone, siltstone, and shale; weathers to pale gray; contains 0.5 to 2-inch-thick (1 - 5 cm) layers of white to light-gray bentonite and a few thin, very fine-grained sandstone beds; rare to common bivalves, ammonites, gastropods, and fish scales; trace fossils are locally common; bedding is poorly developed and is generally lenticular; unit is about 2,000 feet (600 m) thick.*

**Kmf** — Ferron Sandstone Member - *Medium- to dark-gray, interlayered mudstone and siltstone, and pale- to medium-grayish-brown, medium- to very fine-grained sandstone; locally, base is a coarse sandstone up to 5 feet (1.5 m) thick with pebbles up to 0.5 inch (1 cm) in diameter and rare shark teeth; sandstone forms in coarsening-upward sequences that are generally 1 to 5 inches (1 - 12.5 cm) thick; bivalves, trace fossils, and calcite-cored concretions are locally abundant; has ripple laminations, sole marks, and horizontal to lenticular bedding; gradational upper contact; forms a low cuesta in the southern and eastern parts of the quadrangle; unit is about 100 feet (30 m) thick.*

**Kmt** — Tununk Member of the Mancos Shale - *Medium- to dark-gray, brownish-gray, or black mudstone, siltstone, and shale; weathers to pale gray; contains several 0.5 to 2-inch-thick (1 - 5 cm) layers of white to light-gray bentonite and a few dense, thin, very fine-grained sandstone beds; has pods of dark-gray aragonite up to 3 inches (7.5 cm) thick; fossils and trace fossils are locally common; bivalves are locally abundant near the base of the unit; bedding is poorly developed; Coon Spring Sandstone Bed in middle; member is 150 to 200 feet (45 - 60 m) thick; lower part is 80 to 100 feet (24 - 30 m) thick; upper part is 35 to 55 feet (11 - 17 m) thick.*

**Kmtc** — Coon Spring Sandstone Bed of Tununk Member - *Medium- to dark-brownish-gray silty shale with several yellowish-brown to pale-gray, thin, platy, sandstone beds and an interval of large, rounded sandstone concretions up to about 6 feet (2 m) in diameter; fossiliferous; sandstone is very fine grained, very thin bedded, locally hummocky, and forms beds up to about 1 foot (0.3 m) thick; gradational upper and lower contacts; mapped as a marker bed on the sandstone concretions which are commonly the only exposed part of the bed; 35 to 45 feet (11 - 14 m) thick.*

Dakota Sandstone

**Kd** — Undivided - *Shown in cross section only.*

**Kdu** — Upper member - *Pale-yellowish-orange to yellowish-gray, fine- to medium-grained sandstone; rarely contains quartzite cobbles up to about 4 inches (10 cm) in diameter; upper contact is a sharp, irregular surface; is medium- to thick-bedded and dominated by cross-bedding; current directions are dominantly northeast to southeast; forms a resistant bedrock cap wherever exposed; about 15 to 25 feet (4.5 - 8 m) thick in the southern part of the quadrangle; thins toward the north and pinches out near northern limit of outcrops.*

**Kdm** — Middle member - *Medium- to dark-gray carbonaceous shale and mudstone with interlayered lenses of black coal and fine- to medium-grained, thin- to thick-bedded, cross-bedded, channel sandstone deposits; occasional plant fossils; coal forms discontinuous, boney 0.5 to 3-foot- thick (0.15 - 3 m) seams; a channel sandstone bed up to about 20 feet (6 m) thick is present in some outcrops; unit is 40 to 60 feet (12 - 18 m) thick.*

**Kdl** — Lower member - *Pale-yellowish-orange, yellowish-gray, or gray fine- to coarse-grained, quartz sandstone and conglomeratic sandstone; medium- to thick-bedded and generally cross-bedded; conglomerate is lenticular and discontinuous; clasts in the conglomerate are generally less than 1 inch (2.5 cm) in diameter; dense ironstone concretions are abundant; about 20 feet to 50 feet (6 - 15 m) thick; basal contact is a regional unconformity.*

**Kcm** — Cedar Mountain Formation - *Pale-greenish-gray, thin- to medium-bedded sandstone; exposed in only one small outcrop that is 18 feet (5 m) thick; total thickness is 60 to 100 feet (18 - 30 m).*

Subsurface Units

**Jmb** — Morrison Formation-Brushy Basin Member - *Shown in cross section only; 380 to 420 feet (116 - 128 m) thick.*

**Jmst** — Morrison Formation-Salt Wash and Tidwell Members - *Shown in cross section only; combined thickness is about 300 feet (93 m).*

**Jes** — Entrada Sandstone and Summerville Formation - *Shown in cross section only; combined thickness is about 300 feet (93 m).*

**Jk** — Kayenta Formation - *Shown in cross section only; about 250 feet (76 m) thick.*

**Jw** — Wingate Sandstone - *Shown in cross section only; about 300 feet (90 m) thick.*

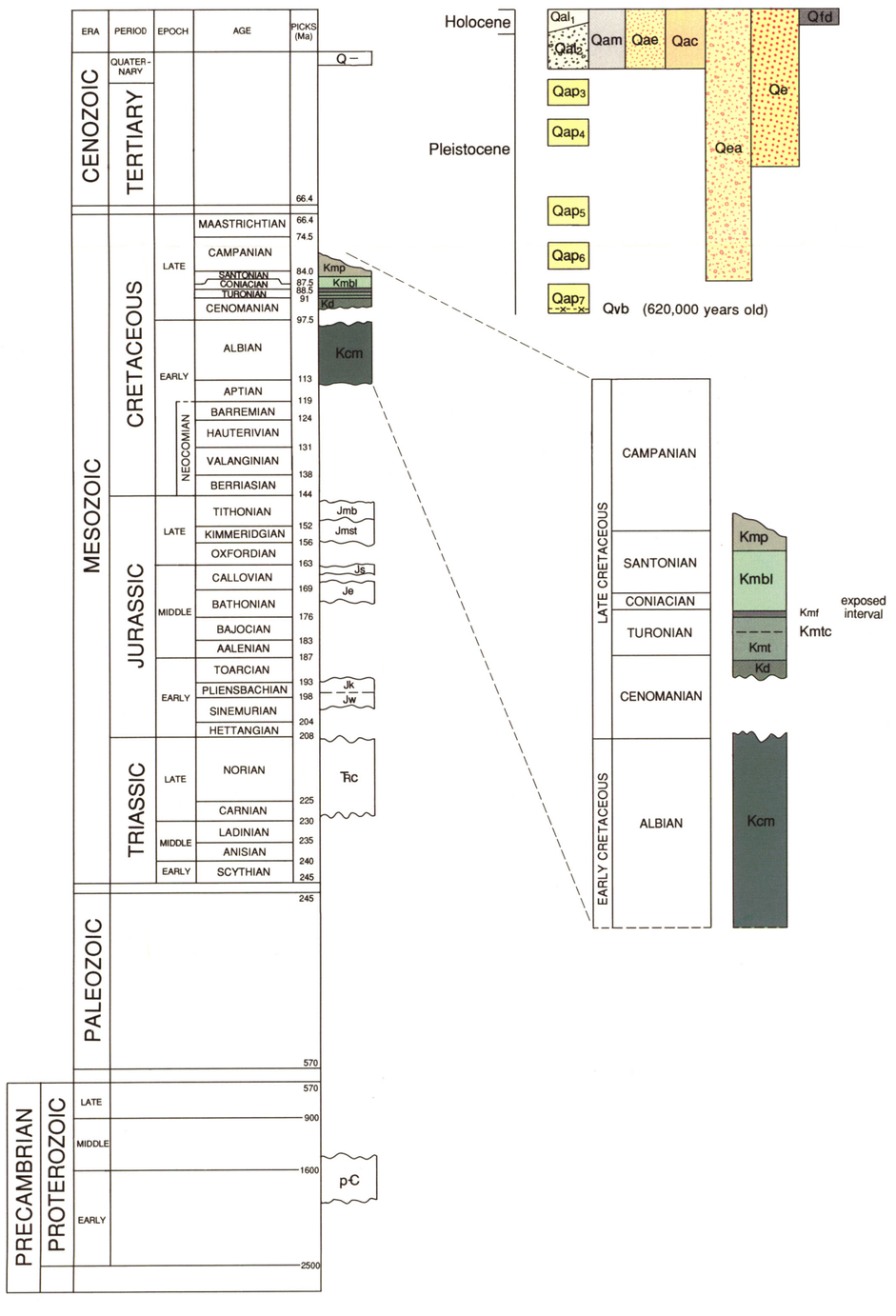
**Trc** — Chinle Formation - *Shown in cross section only; may exceed 100 feet (30 m) thick.*

**p-C** — Undifferentiated high-grade metamorphic and intrusive igneous rock - *Shown in cross section only.*

## MAP SYMBOLS

- Contact, dashed where approximately located
- Fault, dashed where approximately located; bar and ball on downthrown side
- Trace of axial surface of folds--arrow on axis shows direction of plunge; dotted where covered (Anticline / Syncline)
- 4000 — Structural contours--200 foot (60 m) contour interval, datum is top of Dakota Sandstone, long-dashed line is intermediate 100 foot (30 m) contour, short-dashed line shows where datum surface is projected above the ground surface.
- 3 — Strike and dip of bedding
- Volcanic ash deposit
- Gravel or road-fill pit
- 14 — Gas well; numbers refer to table 1 in text
- Well--with show of gas
- Well--dry and abandoned
- Oil or gas well--abandoned

## Correlation of Map Units




| Period | Epoch | Unit | | Thickness ft (m) | Lithology |
|---|---|---|---|---|---|
| Quat. | Pleis.-Holocene | surficial deposits | | 0 - 100 (0 - 30) | |
| CRETACEOUS | Late | Mancos Shale | Prairie Canyon Member | 300+ (90+) | Prairie Cyn sequence boundary |
| | | | lower part of Blue Gate Member | 1600 - 1800 (490 - 550) | |
| | | | Ferron Sandstone Mbr. | 120 - 160 (37 - 49) | Ferron sequence boundary |
| | | | Tununk Shale Member | 35-55 (11-17) | |
| | | | Coon Spring Ss. Bed | 35-45 (11-14) | |
| | | | | 80 - 100 (24 - 30) | |
| | | Dakota Ss. | Upper member | 0 - 25 (0 - 8) | |
| | | | Middle member | 40 - 60 (12 - 18) | Dakota sequence boundary |
| | | | Lower member | 20 - 50 (6 - 15) | |
| | Early | Cedar Mountain Formation | | 60 - 100 (18 - 30) | K unconformity |
| JURASSIC | Late | Morrison Formation | Brushy Basin Member | 380 - 420 (116 - 128) | |
| | | | Salt Wash Member | 200 - 240 (60 - 72) | |
| | | | Tidwell Mbr. | 20 - 40 (8 - 12) | $J_5$ unconformity |
| | Middle | Summerville Formation | | 40 - 55 (12 - 17) | |
| | | Entrada Sandstone | | 275 (84) | $J_2$ unconformity |
| | Early | Kayenta Formation | | 250 (76) | (subsurface units) |
| | | Wingate Sandstone | | 300 - 425 (90 - 130) | |
| TRIASSIC | Late | Chinle Formation | | 40 100 (12-30) | $J_0$ unconformity; $T_3$ unconformity |
| Precamb. | Protero. | Early - Middle | gneiss, granodiorite, gabbro, monzonite | | |

sequence boundary names from Cole and Young (1991)
unconformity names from Pipiringos and O'Sullivan 1978.